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Title: **US3584587: GARBAGE DISPOSAL SYSTEM**

Inventor(s): **Siracusa; Gianni**, Los Gatos, CA 95030 No Image

Applicant/Assignee: **none**

Issued/Filed Dates: **June 15, 1971** / Oct. 20, 1969

Application Number: **US1969000867835**

IPC Class: **F23G 5/12;**

Class: **Current: 110/222;** 110/255; 110/346;
Original: 110/008;

Field of Search: **110/7,8,10,18**

Priority Number(s): Oct. 20, 1969 **US1969000867835**

Legal Status: Show legal status actions

Abstract: An apparatus and method for disposing of garbage and similar refuse by reducing it to pieces of small size to facilitate burning. The reduced refuse is conveyed into an incinerator which has been heated to a predetermined temperature at which the reduced refuse supports combustion. Burners and air supply duct are provided to a side near the bottom of the incinerator so that a whirling and cyclonic motion is imparted to the shredded refuse as it is reduced by complete burning thereof. The ashes and slag resulting from the burning of the reduced refuse drops into the conveyor housing in the bottom of the incinerator and a conveyor moves them to a suitable storage space.

Attorney, Agent, or Firm: **Allen and Chromy ;**

Primary/Assistant Examiners: **Sprague; Kenneth W.**;

Related Applications:

Application Number	ApplDate	Patent	Issued	Title
US1967000674845	1967-10-12	US3473494		

Family: Show known family members

Forward References: Show the 9 patents that reference this one

U.S. References:

Patent	Issued	Inventor (s)	Applicant/Assignee	Title
US2537467*	1 /1951	Komline		
US3064592*	11 /1962	Eberhardt		
US3050202*	8 /1962	Funk		
US3252435*	5 /1966	Bogot et al.		
US3387574	6 /1968	Mullen		SYSTEM FOR PNEUMATICALLY TRANSPORTING HIGH-MOISTURE FUELS SUCH AS BAGASSE AND BARK AND AN INCLUDED FURNACE FOR DRYING AND BURNING THOSE FUELS IN SUSPENSION UNDER HIGH TURBULENCE
US3417717	12 /1968	Jacobovici		FURNACE FOR THE COMBUSTION OF WASTE MATERIALS,PARTICULARLY REFUSE
US3472185	10 /1969	Burden, Jr.		METHOD AND APPARATUS FOR DESTROYING SLUDGE
US3482533	12 /1969	Ankersen		INCINERATORS

* some details unavailable

Claims:
[Hide claims]:

What I claim is:

1. In a method of disposing of refuse such as garbage including vegetable matter and articles made of rubber, plastic, metal, glass, and the like, comprising the steps of: reducing the refuse to be incinerated to small particles, providing an incinerator with fire-resistant walls, conveying the reduced refuse to said incinerator, firing said incinerator to heat the fire-resistant walls thereof to a high temperature of about 2700° F. at which the burnable part of said refuse supports combustion, producing a whirling, cyclonic motion in the atmosphere of hot gases in the incinerator, burning said small, reduced particles of refuse by feeding said refuse into said whirling hot atmosphere of said incinerator so that said refuse is directed toward the walls of said incinerator which have been heated to said high temperature and said refuse reduced by complete combustion of the combustible part thereof and the metal and glass are heated to form a molten slag, and removing the molten slag constituents of said refuse from said incinerator as it flows from the bottom thereof.

2. In a method of disposing of refuse such as garbage including vegetable matter and articles made of rubber, plastic, metal, glass, and the like, comprising the steps of: reducing the refuse to be incinerated to small particles, storing said reduced refuse in a

storage bin, providing an incinerator with fire-resistant walls, conveying the refuse to said incinerator from said storage bin at a predetermined rate, firing said incinerator to heat the fire-resistant walls thereof to a high temperature of about 2700° F. at which the burnable part of said refuse supports combustion, burning said small, reduced particles of combustible refuse in said incinerator while said particles are floating past said high temperature walls, controlling the feeding of said refuse from said storage bin to maintain the temperature of the fire-resistant walls in the burning zone of said incinerator at a level such that a substantial portion of the ash from said burning and noncombustible constituents of said refuse form a molten slag which flows out of the bottom of said incinerator.

3. In apparatus for disposing of refuse such as garbage including vegetable matter and articles made of rubber, plastic, metal, glass, and the like, the combination comprising: means for reducing the refuse to small particles; an incinerator having a substantially circular burning zone lined with a fire-resistant wall and having burners positioned at an angle in said wall so that the hot gases from said burners heat said wall to a high temperature of about 2700° F., means introducing said small particles into said incinerator; means supplying air to said incinerator for imparting a whirling, cyclonic motion to the hot gases thereby sweeping them against the heated fire-resistant wall of said incinerator, said small particles being fed into the central zone of said whirling cyclonic atmosphere in said incinerator, said last-mentioned means maintaining said refuse, at least in part, in suspension as it is whirled in said incinerator and approaches said heated wall while it is burned, and means removing ash-forming constituents of the burned refuse and the noncombustible part from said incinerator in the form of molten slag.

4. In apparatus for disposing of refuse such as garbage including vegetable matter and articles made of rubber, plastic, metal, glass, and the like, the combination comprising; means for reducing the refuse to small particles; an incinerator comprising an elongated tubular member having a lining of fire-resistant material, said incinerator having a burning zone with burners in the side thereof heating the fire-resistant lining to a high temperature, a wall separating said high temperature burning zone from a further zone of said incinerator, said wall having an opening therethrough connecting said burning zone to said further zone, means for feeding said small particles into said burning zone of said incinerator at a predetermined rate; means feeding air into said burning zone to impart rotational motion to said small particles of refuse in said incinerator, means feeding air in said opening in said wall and into said further zone, and means removing a substantial portion of the ash-forming and noncombustible constituents of said refuse from said incinerator in the form of molten slag.

5. In apparatus for disposing of refuse such as garbage including vegetable matter and articles made of rubber, plastic, metal, glass, and the like, the combination comprising: means for reducing the refuse to small particles; a storage bin, means conveying said reduced refuse to said storage bin, an incinerator comprising an elongated tubular member having a lining of fire-resistant material, said incinerator having a burning zone with burners in the side thereof heating the fire-resistant lining to a high temperature, a wall separating said high temperature burning zone from a further zone of said incinerator, said wall having an opening therethrough connecting said burning zone to said further zone, means feeding said small particles from said storage bin into the central zone of said incinerator at a predetermined rate which is not dependent

This application is a continuation-in-part of my application Ser. No. 674,845 filed Oct. 12, 1967 now U.S. Pat. No. 3,473,494.

Background/Summary:

This invention relates to an apparatus and process for disposing of finely divided refuse such as garbage.

Another object of this invention is to provide an improved apparatus and process for disposal of finely divided refuse such as garbage by incineration which proceeds on a continuous basis in a preheated incinerator which is first brought up to a predetermined temperature by one or more gas-fired burners and thereafter the incineration process is maintained by burning of the finely divided refuse itself.

Another object of this invention is to provide an improved apparatus and process for the disposal of finely divided refuse such as garbage by incineration in an incinerator into which the finely divided refuse is propelled and in which it is agitated by air so that the combustible constituents of the refuse are burned and the noncombustible constituents are allowed to drop into the bottom of the incinerator from which they are removed by a conveyor connected thereto.

Another object of this invention is to provide an improved apparatus and process for disposal of finely divided refuse such as garbage by incineration in an incinerator which is provided with wall structure shaped to enhance the draft therethrough by which the gases of combustion and suspended ash are moved from the incinerator and into a settler chamber, electrostatic or cyclone precipitator which may be vented to the atmosphere.

Another object of this invention is to provide an improved apparatus and process for disposal of refuse such as garbage in which both the combustible refuse and noncombustible refuse, such as glass and the like, are reduced to fine particles by appropriate apparatus and thereafter the reduced refuse is blown into the hot preheated zone of the incinerator in which it sustains combustion, and in which any glass or the like is melted to form a slag which flows down an inclined bottom part of the incinerator to a conveyor that transports it to a storage area.

A further object of this invention is to provide an improved apparatus and process for disposal of refuse such as garbage in which the combustible refuse is reduced to fine particles which are fed to a preheated incinerator which has been brought up to a predetermined temperature prior to the feeding of the combustible refuse thereinto, the feeding of the combustible refuse into the incinerator being at a rate to maintain the burning zone of the incinerator at substantially this predetermined temperature by the combustion of the combustible refuse.

Other and further objects of this invention will be apparent to those skilled in the art to which it relates from the following specification, claims and drawing.

In accordance with this invention I have provided an improved apparatus and process for the disposal of finely divided refuse such as garbage. The garbage may be initially treated as described in my copending application whereby it is broken up and shredded into fine particles. In this apparatus and process the refuse, after being loosened by suitable agitation, is passed under one or more separating magnets or over suitable magnetic pulleys so that magnetic material, particularly the larger pieces of iron, are removed therefrom. Thereafter the refuse, including the combustible material and glass bottles, is broken up by suitable grinding and shredding to reduce it to fine particles. The reduced

refuse is fed to a vibrating screen or foraminous member which is provided with holes on the order of one-quarter inch to one-half inch in diameter. The particles of broken glass drop through this screen together with a small portion of the combustible material. Most of the combustible material passes over the top of this screen.

The combustible portion of finely divided refuse is transported from the top of the vibratory screen to a conveyor that is connected to a feedpipe for feeding it into the input of the incinerator, into which it is blown through the pipe by compressed air which may be preheated. The finely divided refuse is blown against a baffle structure which is provided with veins which may be of a spiral configuration to impart a swirling motion to the finely divided garbage. The material falling through the screen, including the ground up glass, is fed to a conveyor located at the side of the incinerator which is connected by suitable ducts to the interior of the incinerator through which this material falls into the incinerator so that this portion of the refuse is also subjected to incineration.

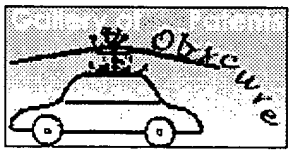
The incinerator of this apparatus is first preheated to a relatively high temperature of approximately 2700° F., although, of course, higher or lower temperatures may be employed, depending upon the nature of the garbage, particularly the water content thereof. This preheating of the incinerator brings the heat resistant lining, which is of fire brick, to this combustion sustaining temperature. The finely divided refuse is then blown into the incinerator by compressed air which separates the refuse particles. Suitable baffle structure may be provided to cause the refuse particles to float and swirl around in the incinerator during burning thereof. Thereafter the gases from the incinerator are passed through a series of water sprays.

Drawing Descriptions: Show drawing descriptions

Description of Preferred Embodiments: Show description of preferred embodiments

Foreign References: **none**

No patents reference this one



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This application is a continuation-in-part of my application Ser. No. 674,845 filed Oct. 12, 1967 now U.S. Pat. No. 3,473,494.

Background/Summary: Show background/summary

Drawing Descriptions:

Further details of this invention will be apparent to those skilled in the art to which it relates from the following specification, claims and drawings in which, briefly:

FIG. 1 is a schematic diagram showing the different stages or steps of treatment of the refuse such as garbage preliminary to the incineration thereof;

FIG. 2 is a plan view of the incineration and washing stages of this apparatus;

FIG. 3 is a sectional view taken along the line 3-3 of FIG. 2;

FIG. 4 is a view in side elevation of the apparatus shown in FIG. 2;

FIG. 4a is a view of a modified form of this apparatus;

FIG. 5 is a sectional view taken along the line 5-5 of FIG. 4;

FIG. 6 is a sectional view taken along the line 6-6 of FIG. 4;

FIG. 7 is a side view partially broken away of the forward part of the incinerator; and

FIG. 7a shows a modified form of incinerator with the burners positioned on one side near the bottom;

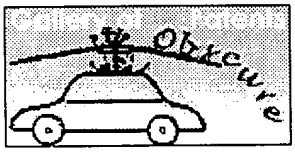
FIG. 8 is a side view partially broken away of the rear part of the incinerator.

FIGS. 7 and 8 are to be combined as shown in the small block diagram below FIG. 8 to illustrate the complete incinerator.

Description of Preferred Embodiments: Show description of preferred embodiments

Foreign References: **none**

No patents reference this one



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This application is a continuation-in-part of my application Ser. No. 674,845 filed Oct. 12, 1967 now U.S. Pat. No. 3,473,494.

Background/Summary: Show background/summary

Drawing Descriptions: Show drawing descriptions

Description of Preferred Embodiments:

Referring to the drawing in detail, reference numeral 1 designates a conveyor which transports the garbage or other refuse to the beater mechanism 2 in which the compacted refuse is loosened and fed to the conveyor 3 which carried the loosened refuse through the magnetic separator stage 4. Stage 4 is provided with one or more electromagnets of conventional construction which pick up the magnetic refuse and move it to a conveyor so that it is removed from the line of treatment of the refuse. The other refuse, including the combustible portion, and the glass is transported by the conveyor to the grinding and shredding apparatus which includes stages 5, 5a and 5b. The refuse is reduced to fine particles in this multiple stage grinder and shredder and is then moved by conveyor 6 to the vibratory separator which includes the vibrating foraminous member 7. The foraminous member 7 is supported by suitable rollers 7a in a slightly inclined position and it is connected by a member 7b to the eccentric 7c which vibrates the foraminous member back and forth as the finely divided refuse is fed thereto at the upper end. During vibration of the foraminous member 7, the combustible refuse moves thereover downward to the hopper 7e. However, some of the combustible refuse and most of the ground up glass pass through the foraminous member and fall to hopper 7d. Hopper 7e is connected to the pipe 13 which is provided with a screw conveyor 8. The screw conveyor 8 moves the combustible refuse to the input end of the incinerator shown in FIGS. 2, 4 and 7. The refuse dropping into hopper 7d is removed by screw conveyor 9 which is connected to supply this portion of the ground up refuse to the input of the screw conveyor 16 which is located at the side of the incinerator 10.

If desired the vibratory separator may be eliminated and the reduced refuse fed by conveyor 6 to conveyor 13 and into the incinerator 10.

The end wall 10a of the incinerator is provided with two gas burners 11 and 12 positioned on the sides of the main feedpipe 13 through which finely divided garbage is blown into the incinerator by compressed air supplied through pipe 13a. The incinerator is provided with two screw conveyor housings 14 and 15 which communicate with the inside thereof by a plurality of ducts 14a and 15a, respectively. Some of the fine ash may enter duct 14 at the burner end of the incinerator and be carried thereby to the rear where it and the ground up glass is dropped through holes 14a into the incinerator. The ducts 14 and 15 are provided with screw conveyors 16 and 17, as shown in FIGS. 3 and 4, so that the ashes and other material entering the ducts 14 and 15 from the incinerator through the connecting ducts 14a and 15a, respectively, do not accumulate therein but are moved by the screw conveyors 16 and 17 to the rear of the incinerator. Conveyor 16 empties the material moved thereby into the rear part 24 of the incinerator where it is incinerated and falls through the bottom holes into duct 15. Conveyor 17 carries the noncombustible incinerated refuse to the settler chamber 18.

The incinerator 10 is provided with an outer shell 19 of metal such as steel, stainless steel, or the like, and an inner lining 20 of

fire brick or other heat resisting material which is adapted to be heated to a temperature of approximately 2700° F. by the gas burners 11 and 12 before the finely divided and shredded refuse, such as garbage, is blown into the incinerator through the inlet 13. The lining 20 should be thick enough so that it will decrease the tendency of heat being passed therethrough to the outer shell 19, and also so that it will retain sufficient heat after being raised to the combustion temperature, whereby the burning of the refuse will continue, after the burners are turned off, in a continuous process as long as the finely divided refuse is fed to the incinerator at a predetermined rate.

The gas burners 11a may be positioned on the side of the incinerator and near the bottom thereof as shown in FIGS. 4a and 7a instead of the end as shown in FIG. 7. Preheated air is fed into the incinerator through pipe 13b from the heat exchanger 13c. Burners 11a and preheated air produce a cyclonic action in the incinerator and heat the brick liner. This action swirls the reduced waste, fed into the combustion chamber, in the hot zone of the chamber and the reduced waste is completely incinerated. The molten glass flows down the bottom of the chamber to the hole 15b leading to slag conveyor 17a.

The finely divided garbage or other refuse is supplied to the feedpipe 13 by a suitable conveyor which may be a screw-type conveyor (not shown) and this finely divided garbage or other refuse is carried by compressed air supplied through pipe 13a so that the finely divided refuse is blown against the apex end of the conical deflector 22 which is supported on the inner end of the feedpipe 13 by a plurality of arms 21. One or more compressed air pipes such as pipe 13a are connected to pipe 13 at the front of the incinerator to move the refuse from the end of the conveyor in pipe 13 into the burning zone of the incinerator. The outside of the conical deflector 22 is provided with veins 23 which are slightly curved, as shown, so that the finely divided refuse passing along the outside of the deflector 22 is given a somewhat spiraling motion as it leaves this deflector. Thus, the finely divided refuse is swirled into the hot incinerator to facilitate the burning thereof. At the same time, the broken up noncombustible material such as glass that may be adhering to the combustible material drops out of the finely divided refuse and enters one or more of the short ducts 15a through which it passes to the pipe 15 and is moved by the screw conveyor 17 to the rear of the incinerator and into the settler chamber 18. Some of the fine ash enters the short ducts 14a into the pipe 14 and is carried to the rear by the screw conveyor 16. The conveyor pipes 14 may be positioned on both sides of the incinerator or only on one side, as desired.

In the embodiment of the incinerator shown in FIGS. 4a and 7a the burners 11a and preheated air supply duct 13b are positioned on one side of the incinerator near the bottom. With this arrangement the interior brick walls of the incinerator are heated to about 2700° F. as the burning gases from the burners 11a impinge the brick walls in a whirling, cyclonic motion. The refuse reduced to small pieces as previously described is placed in the storage bin through pipe 13d and moved therefrom by conveyor 13a which feeds it into the incinerator 10. A draft is produced in the incinerator by the blower 13e which is connected by duct 13f to the top of the heat exchange chamber 13c. The heat exchange chamber 13c is connected to the end of the incinerator and it is also provided with an array of tubes which are heated by the bases leaving the incinerator. These tubes extend between headers 13g and 13h and header 13h is connected to the air duct 13b. Header 13g is connected by a duct to blower 13i which feeds air to be preheated

to the tubes in the heat exhanger 13c. The preheated air is fed by pipe 13b to the incinerator at 13k and it is also fed by duct 13m to the cavity 20b in the wall 20a of the incinerator. The cavity 20b is connected to the interior of the incinerator by ports 20c which feed air into said interior. Suitable valves 13k' and 13m' may be provided in the ducts 13k and 13m to control the amount of air supplied to the incinerator so that the temperature in the burning zone and of the spent gases may be controlled.

The wall 20a which is positioned after the hot burning zone is constricted to increase the velocity of the atmosphere in the incinerator at the inlet to the smaller incinerator chamber 24. The outlet of chamber 24 is connected to pipes 25 which pass through the heat exchanging chamber 26. Chamber 26 is in the form of a steam boiler which may be of conventional construction. The water in the boiler is heated to produce steam from the pipes 25 through which the hot gases pass from the incinerator to settler 18. The steam may of course be used as is well known for heating or power purposes. Settler 18 is provided with a manifold 27 positioned on the outside thereof and a plurality of nozzles 28 are positioned in holes formed in the walls of the settler through these nozzles. Water under suitable pressure is supplied to the manifold 27 through the pipe 29 which is connected to the pump 30 driven by motor 31. Thus, the gases and some of the fine ash from the incinerator are subjected to a preliminary washing in the settler 18.

A pipe 32 is connected to the top of this settler 18 and through this pipe the gases from the settler are transmitted to the washing tank 33. The outlet of tank 33 is connected by pipe 34 to the inlet of another tank 35. Both of the tanks 33 and 35 are draped with water pipes 36 which are connected to pump 37 driven by motor 38 so that water under pressure is supplied to these pipes. Suitable holes are provided in the walls of tanks 33 and 35 and nozzle-supporting pipes 39 are positioned in these holes so that water spray may be provided to the insides of these tanks. Each of the nozzle-supplying pipes may be provided with a suitable valve which is adapted to be controlled from the outside of the tank so that different ones of the nozzles may be turned either on or off, as may be desired, during the operation or servicing of this apparatus.

Duct 34 is also provided with a water spray therein. This spray is supplied from suitable nozzles supported in the duct 34 by the water feedpipes 40 which are positioned in holes formed in the wall of the duct and which support suitable nozzles on the inside. The forward part of the duct 34 functions as a housing for a fan which draws the gases out of tank 33 and blows these gases into tank 35.

Tanks 33 and 35 are provided with baffles in the insides thereof attached to the upper parts of the tank walls so that these baffles extend down about midway in the tanks. The tanks 33 and 35 are approximately half filled with water. As the gases circulate in the tanks 33 and 35 between the baffles which are arranged so that the paths therethrough are of a serpentine nature, the gases are exposed to the water sprays and are also driven by these sprays into contact with the water in the tanks.

The bottom of each tank 33 and 35 is provided with a suitable duct which is provided with holes which open into the insides of the tank. Thus, all solid matter washed out of the gases is accumulated in this duct and is carried therefrom by the screw conveyor positioned therein, as shown in FIG. 4. Screw conveyor 42 of tank 35 is connected to the screw conveyor 44 by suitable universal coupling. Conveyor 44 is positioned in the duct 43 which leads to the upper part of the settler 18. Thus, the fine noncombustible material washed out of the gases in tank 35 is moved to the upper part of the settler 18 by conveyor 44 through duct 43. A similar

conveyor apparatus is provided to tank 33 which also moves the noncombustible material precipitated in this tank and drops it into the top of settler 18. The bottom of settler 18 is provided with inclined walls so that the noncombustible material moves down these inclined walls to the conveyor 18a, which is also of the screw type, and this conveyor moves this material out of one side of the settler.

The washed gas is transmitted through pipe 45 which is connected to the outlet of tank 35 and which exhausts the washed gas to the atmosphere through the stack 46.

In FIG. 4a I have shown an incinerator system in which the incinerator 10 is connected to a heat exchanger 13c that is provided with an array of tubes which are heated by the hot gases coming from the incinerator. The gases and fly ash are drawn up into the duct 13f by the blower 13e. Blower 13e blows the gases and fly ash into the cyclone separator 13p through duct 13o in which the fly ash is removed before the gases are released to the atmosphere. Cyclone separator 13p is of conventional construction and is provided in this embodiment of the invention in place of the water spray tanks 33 and 35 shown in FIGS. 2 and 3. On the other hand if sufficient swirling and cyclonic motion is provided in the incinerator then the fly ash may be deposited on the hot surfaces of the brick lining the incinerator so that the cyclone separator 13p may become unnecessary.

In practicing this invention I have found that, in disposing of refuse such as garbage and the like, it is first necessary to agitate the refuse to loosen and break up the parts that are compacted so that iron objects which are magnetic may be more easily and readily separated from the refuse when it is passed through the magnetic separator. The refuse which then includes the combustible material and noncombustible material such as glass bottles and the like is then passed through one or more stages of hammering and shredding apparatus in which the refuse is reduced to small particle sizes.

The refuse is then conveyed to a separator which separates the principal amount of combustible refuse from the reduced noncombustible refuse so that thereafter the combustible refuse may be readily blown with an airstream into the hot preheated forward zone of the incinerator without being loaded down with the relatively heavy noncombustible refuse made up of the reduced glass and the like. The reduced noncombustible refuse and any combustible refuse adhering thereto is conveyed to a zone of the incinerator beyond the forward zone and deposited into it through suitable ports so that the combustible part thereof is also burned. The glass slag and other ash falls to the bottom of the incinerator and is carried off by a conveyor. The combustible and noncombustible refuse need not be separated when the temperature of the incinerator is raised to 2700° F. The slag then is in molten condition and runs down the inclined bottom of the incinerator to the hole 15b shown in FIG. 7a. This molten slag includes the noncombustibles and the weight thereof trips the door on the bottom of hole 15b. The slag then drops down into the water surrounding conveyor 17a which moves the solidified slag to a suitable storage area.

The combustible refuse is fed to the incinerator at a predetermined rate such that its combustion will maintain the temperature in the incinerator at that to which it was preheated. For this purpose the speed of the conveyor moving the combustible refuse to the incinerator may be varied by conventional means so that the temperature in the incinerator, as indicated by conventional

indicating means, is kept at or near the predetermined value.

Conveyor 13a shown in FIG. 4a feeds the reduced refuse from the storage bin to the incinerator. Suitable conveyors (not shown) may be provided in the storage bin to move the refuse to conveyor 13a. These conveyors are driven by suitable motors through reduction gearing of conventional construction so that the speeds of these conveyors may be controlled and the feeding of the refuse to the incinerator varied so as to maintain the temperature of the incinerator at the desired value. The temperature may also be controlled or varied by varying the quantity of air fed into the incinerator through ducts 13k and 13m. Air is also fed to the incinerator through ducts 13n to cool the gases resulting from combustion somewhat before these gases enter the heat exchanger.

While I have shown a preferred embodiment of this invention, it will be understood that the invention is capable of variation and modification from the form shown so that the scope thereof should be limited only by the proper scope of the claims appended hereto.

Foreign References: **none**

No patents reference this one